Abstract

The evidence of a flood wave passing through a catchment remains visible even for a long time after it occurs. The morphological update in the channel and floodplains, together with the processes related to the mass transport within the aquatic environment, can be regarded as flood event evidence. The advancement in hydroinformatics brought the development of numerical modeling as a tool for the solution of broad hydrological tasks. Thanks to the scenario modeling, flood events with interconnected processes can be explored in detail. This thesis is broadly focused on the mass transport initialization issue both in the polluted and clear middle-European water environments. The aim of the thesis is the evaluation of the principal issues connected with the mass transport initialization based on complex and integrated numerical modeling.

The thesis brings original datasets resulting from several case studies. The aim of the thesis is also to bring a comparative study of methodological approaches evaluating the possibilities and limits regarding the accuracy of inputs vs. outputs and computational time requirements. This thesis also brings several useful comparisons and innovative solutions design.

The mass transport initialization issue is solved in both balance and event-scale processed-based models. The partial outputs are the general water quality improvement measures designed to fulfill the European legislative requirements. The particular site-specific threshold values of the flow parameters necessary for the mass transport initialization are evaluated. Those values vary from 0.12 – 7.8 N•m-2 in the case of the middle and the lower river reaches to 16.3 ± 8.2 N•m-2 regarding the coarser gravels of the upper river reach.

In order to relate the causal hydrological conditions, the results were relativized by the statistical evaluation of the event return period (QN, Qm). Even though the causal conditions for the mass transport initialization are site-specific, the thesis aims to find regularities and link the different geographical sites regarding the mass transport initialization tendency.

The return period is used as the results' interconnecting parameter rather than a prognostic tool. Nevertheless, regarding hydrological non-stationarity, the influence of the trend behavior of the hydrological system due to the abiotic and biotic factors must be considered. The trend behavior can be representatively studied in the catchments without structural changes or where those changes are well-known. In the case of this thesis, the influence of the climate change and natural disturbances' effects on the hydrological process was studied. Even though the study did not prove any significant influence of the drivers on the high-flow events' magnitude, the increment of flooding frequency is obvious. From this statement, there is a clear underestimation of the remobilization frequency if the results will be used in a prognostic sense.